

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 February 2002 (07.02.2002)

PCT

(10) International Publication Number  
WO 02/11315 A3

(51) International Patent Classification?: H04B 7/06

(21) International Application Number: PCT/US01/22527

(22) International Filing Date: 17 July 2001 (17.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
09/630,750 2 August 2000 (02.08.2000) US

(71) Applicant: ERICSSON INC. [US/US]; 511 Davis Drive,  
Research Triangle Park, NC 27709 (US).

(72) Inventors: RAMESH, Rajaram; 403 Danton Drive, Cary,  
NC 27511 (US). ZANJI, Kambiz, C.; 6 Colton Court,  
Durham, NC 27713 (US).

(74) Agents: OWEN, John, R. et al.: Coats & Bennett, PLLC,  
Post Office Box 5, Raleigh, NC 27602 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,  
SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

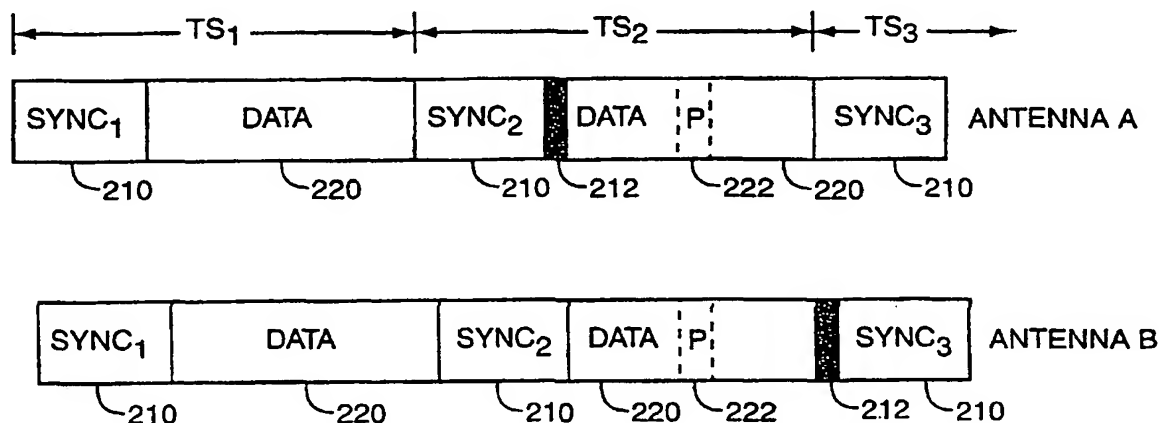
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,  
CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD,  
TG).

Published:  
— with international search report

(88) Date of publication of the international search report:  
27 June 2002

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: HYBRID TRANSMIT DIVERSITY



(57) Abstract: An approach to hybrid transmit diversity which involves the transmission of information using different forms of transmit diversity for at least two adjacent time slots is disclosed. A base station transmits information using a first transmit diversity technique during a first time slot and then using a second transmit diversity technique in an adjacent time slot, such as the next subsequent time slot. Thus, a base station may transmit information to mobile terminal X using delay diversity during one time slot and then transmit information to mobile terminal Y using space-time diversity during the next time slot. This approach may also be used to transmit the GSM the FCCH with combined delay diversity and antenna hopping diversity (actual or virtual) while other GSM channels are transmitted with just delay diversity. Methods are also disclosed for accommodating the change in diversity techniques between the time slots that involve either transmitting dummy symbol(s) as part of the data field or stealing symbol(s) from the sync field to use in the data field.



WO 02/11315 A3

# INTERNATIONAL SEARCH REPORT

Inte. l.ional Application No

PCT/US 01/22527

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B7/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	<p>WO 00 11806 A (ERICSSON INC) 2 March 2000 (2000-03-02)</p> <p>abstract page 5, line 7 - line 23 page 14, line 9 -page 15, line 14; figures 4,5 page 16, line 23 -page 17, line 2 page 18, line 3 - line 9; figure 6 page 19, line 17 -page 21, line 3</p> <p>--- -/--</p>	<p>1,2,5, 30-34 3,4, 6-13, 23-29, 35-37</p>



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*Z\* document member of the same patent family

Date of the actual completion of the international search

22 March 2002

Date of mailing of the international search report

04/04/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

Sieben, S

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/22527

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	WO 99 59263 A (SAMSUNG ELECTRONICS CO LTD) 18 November 1999 (1999-11-18)  abstract page 2, line 20 -page 3, line 9 page 4, line 14 - line 21 page 6, line 21 -page 8, line 9; figures 1A,1B page 11, line 10 - line 18; figure 2 page 12, last line -page 14, line 1; figure 3	1-6, 14-22 7-13, 35-37 30-34
Y A	GB 2 237 706 A (RACAL RES LTD) 8 May 1991 (1991-05-08)  abstract page 10, line 21 -page 12, line 4; figures 1,4,5	7-13, 35-37 1-6, 23-34
A	THOMPSON J S ET AL: "DOWNLINK TRANSMIT DIVERSITY SCHEMES FOR CDMA NETWORKS" VTC 1999-FALL. IEEE VTS 50TH. VEHICULAR TECHNOLOGY CONFERENCE. GATEWAY TO THE 21ST. CENTURY COMMUNICATIONS VILLAGE. AMSTERDAM, SEPT. 19 - 22, 1999, IEEE VEHICULAR TECHNOLOGY CONFERENCE, NEW YORK, NY: IEEE, US, vol. 3 CONF. 50, 19 September 1999 (1999-09-19), pages 1382-1386, XP000922334 ISBN: 0-7803-5436-2 page 1383, left-hand column, line 24 -page 1384, left-hand column, line 4	1-37
A	HEATH R W JR ET AL: "Transmit diversity using decision-directed antenna hopping" COMMUNICATION THEORY MINI-CONFERENCE, 1999 VANCOUVER, BC, CANADA 6-10 JUNE 1999, PISCATAWAY, NJ, USA,IEEE, US, 6 June 1999 (1999-06-06), pages 141-145, XP010351114 ISBN: 0-7803-5653-5 abstract page 142, left-hand column, line 12 - line 30 page 144, right-hand column, line 35 -page 145, left-hand column, line 9; figure 6	1-37
A	US 5 960 330 A (AZUMA TOMOHIRO) 28 September 1999 (1999-09-28) column 3, line 17 - line 22; figure 1	1-37

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/22527

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0011806	A	02-03-2000	AU 5681099 A WO 0011806 A1	14-03-2000 02-03-2000
WO 9959263	A	18-11-1999	AU 3735599 A BR 9910317 A CN 1300479 T EP 1078477 A1 WO 9959263 A1	29-11-1999 25-09-2001 20-06-2001 28-02-2001 18-11-1999
GB 2237706	A	08-05-1991	NONE	
US 5960330	A	28-09-1999	JP 3111906 B2 JP 10032527 A AU 712944 B2 AU 2869197 A CA 2210578 A1 CN 1171670 A GB 2315645 A ,B	27-11-2000 03-02-1998 18-11-1999 29-01-1998 17-01-1998 28-01-1998 04-02-1998